ICSE SEMESTER 2 EXAMINATION

SPECIMEN QUESTION PAPER

PHYSICS

(SCIENCE PAPER 1)

Maximum Marks: 40

Time allowed: One and a half hours

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 10 minutes.

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

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*Attempt **all** questions from **Section A** and **any three** questions from **Section B**.*

The intended marks for questions or parts of questions are given in brackets [ ].

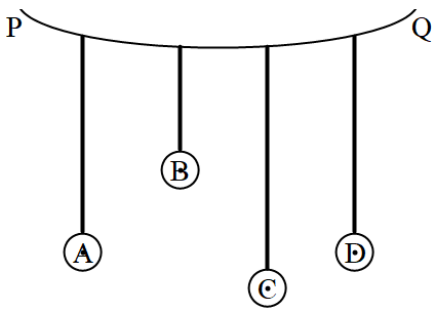
SECTION A

*(Attempt **all** questions.)*

Question 1

Choose the correct answers to the questions from the given options. (Do not copy the question, Write the correct answer only.)

(i) Pendulums A, B, C and D are tied to a flexible string PQ and are at rest. Pendulum C is disturbed. Which of the following statements is true? [1]



(a) Only pendulum C will start vibrating.

(b) Pendulums A, B, and D will also start vibrating but A and D will vibrate with the maximum amplitude.

(c) Pendulums A, B, and D will also start vibrating.

(d) Vibrations of pendulum C are forced vibrations.

(ii) Which of the following is **not a** characteristic of parallel combination of resistors? [1]

(a) If one resistor is fused, the circuit does not become open.

(b) The total resistance R is given by the formula $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots\ldots$

(c) The total resistance becomes less than the least resistor, present in the combination.

(d) The current through each resistor always remains the same.

(iii) Which one of the following statements is correct? [1]

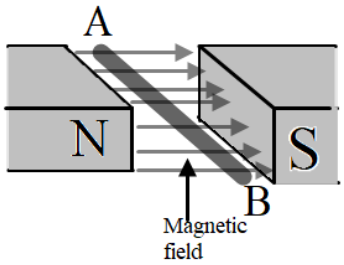
(a) Live wire has zero potential.

(b) Fuse is connected in a neutral wire.

(c) Potential of live and earth wire is always the same.

(d) Earth wire is used to prevent electric shock.

(iv) The diagram below shows a free conductor AB is kept in a magnetic field and is carrying current from A to B. (To avoid confusion complete path of the circuit is not shown) The direction of the force experienced by the conductor will be: [1]



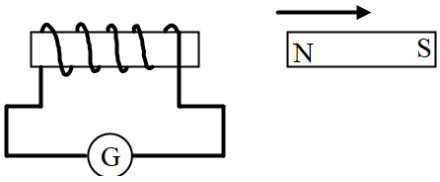
(a) Up

(b) Down

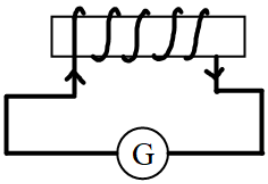
(c) Towards N

(d) Towards S

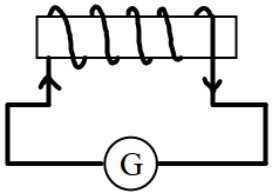
(v) The diagram below shows a magnet moved near a coil along its axis. Which of the diagram shows correct flow of current during this motion? [1]



(a)



(b)



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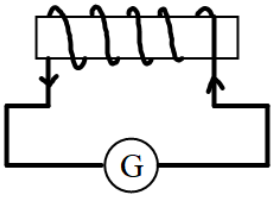
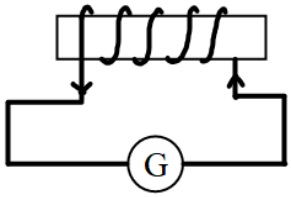


(d)



(vi) The meaning of the statement 'Specific heat capacity of water is 4200 $Jkg^{-1}K^{-1}$' is: [1]

(a) Water needs 4200 J heat to raise its temperature by 1 kelvin.

(b) To raise the temperature of water 4200 J of heat is absorbed.

(c) 1 kg water absorbs 4200J heat to increase its temperature by 1 kelvin.

(d) 1 kg Water needs 1 kelvin temperature to absorb 4200 J heat.

(vii) 200 g of ice at 0^0C needs _____ heat to melt. [Specific latent heat of ice = 336000 J kg^{-1}] [1]

(a) 6720 J

(b) 67200 J

(c) 672000 J

(d) 67.2 J

(viii) The radiation with maximum penetrating power is: [1]

(a) γ

(b) β

(c) X-radiation

(d) α

(ix) Resonance is: [1]

(a) A forced vibration in which amplitude remains constant.

(b) A forced vibration in which frequency of forced vibration is greater than the free vibrations of the body.

(c) A forced vibration, in which frequency of forced vibration is equal to the free vibrations of the body.

(d) A forced vibration, in which frequency of forced vibration is less than the free vibrations of the body.

(x) The nuclear radiation which gets deflected towards negatively charged plate in an electric field is: [1]

(a) Gamma

(b) Ultraviolet

(c) Beta

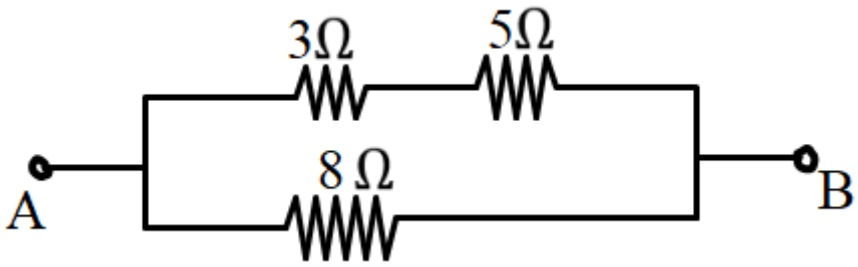
(d) Alpha

SECTION B

*(Attempt **any three** questions from this Section.)*

Question 2

(i) (a) Calculate the total resistance across AB. [3]

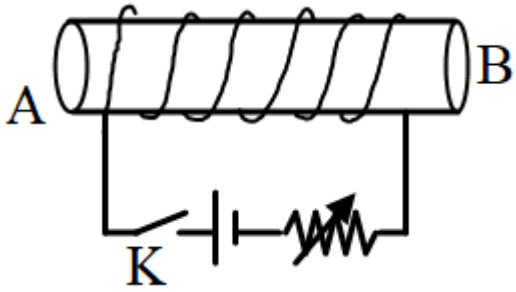


(b) If a cell of e.m.f 2.4 V with negligible internal resistance is connected across AB then calculate the current drawn from the cell.

(ii) (a) Which will absorb more heat, 10 g of ice at 0^0C or 10 g of water at 0^0C? [3]

(b) For the same mass of ice and ice-cold water, why does ice produce more cooling than ice-cold water?

(iii) The diagram below shows an insulated copper wire wound around a hollow card board cylindrical tube. Answer the questions that follow: [4]



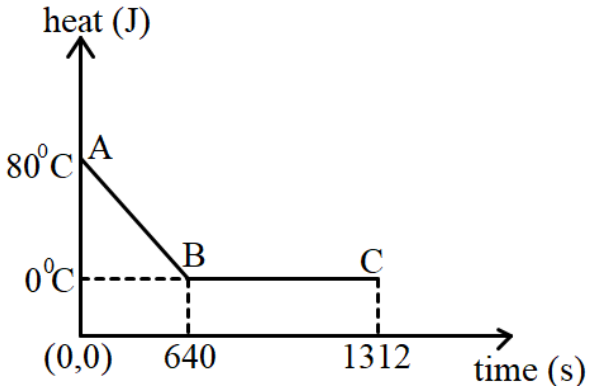
(a) What are the magnetic poles at A and B when the key K is closed?

(b) State two ways to increase the strength of the magnetic field in this coil without changing the coil.

(c) If we place a soft iron bar at the centre of the hollow cardboard and replace the DC source by an AC source then will it attract small iron pins toward itself when the current is flowing through the coil?

Question 3

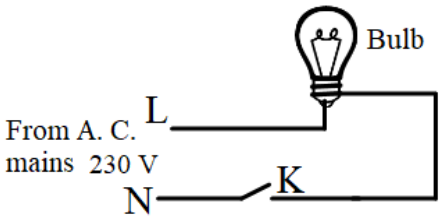
(i) The diagram below shows a cooling curve for 200 g of water. The heat is extracted at the rate of 100 Js^{-1}. Answer the questions that follow: [3]



(a) Calculate specific heat capacity of water.

(b) Heat released in the region BC.

(ii) (a) Observe the diagram given below and state whether the bulb will glow or not when we switch on K. [3]



(b) Is it safe to handle the bulb when the switch is OFF?

(c) Give a reason for your answer in (b).

(iii) Two metals A and B have specific heat capacities in the ratio 2:3. If they are supplied same amount of heat then [4]

(a) Which metal piece will show greater rise in temperature given their masses are the same?

(b) Which metal piece will have greater mass if the rise in temperature is the same for both metals?

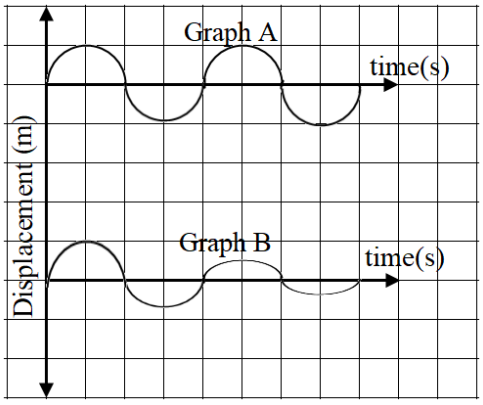
(c) If the mass ratio of metal A and metal B is 3:5 then calculate the ratio in which their temperatures rise.

(d) If specific heat capacity of metal A is 0.26 $Jg^{-1}\,{}^{0}C^{-1}$ then calculate the specific heat capacity of metal B

Question 4

(i) (a) Which one of the following graphs A or B shows free vibrations in vacuum and which one shows free vibrations in a medium? [3]

(b) How did you come to this conclusion.



(ii) (a) State the Faraday's laws of electromagnetic induction [3]

(b) Name one electrical device which works on this principle.

(iii) A nucleus $^{194}_{82}X$ emits an alpha particle [4]

(a) What will be the atomic number of the daughter nucleus Y?

(b) What will be the number of neutrons in the daughter nucleus Y?

(c) Write a nuclear reaction showing the emission of this particle.

Question 5

(i) (a) Name the electrical appliance shown in the diagram below. [3]

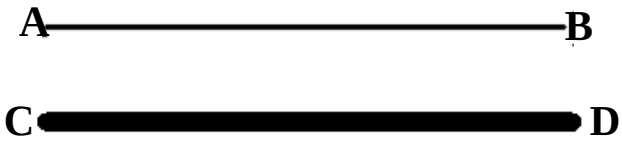
(b) Name the material of the wire used in this device.

(c) Name two important characteristics of this wire.

(ii) (a) Define pitch. [3]

(b) Two wires AB and CD of same length are stretched by same amount. Which wire will produce sound of greater pitch on plucking?

(c) Give a reason for your answer.



(iii) (a) Why is water used as a coolant in radiators of a car? [4]

(b) Name the radioactive isotope used to find the age of fossils. Name the radioactive radiation which it emits?

Question 6

(i) A beam of α, β and γ rays is travelling through a certain region in space. [3]

(a) Arrange them in ascending order of ionising power.

(b) Which of the above will pass undeviated if subjected to an electric field?

(c) With respect to your answer to part (b) above, what will be the change in the nucleus of an atom after such a ray is emitted.

(ii) A change in amplitude of a sound wave is noticed. [3]

(a) Which characteristic of sound is affected due to the above change?

(b) How is amplitude related to your answer to part (a) above?

(c) What happens to the quality of the sound?

(iii) An electric bulb is rated '240 V, 100 W'. [4]

(a) What information can you get from the above statement?

(b) What will happen if this bulb is connected across 220 V?

(c) Calculate the resistance of the bulb.

(d) Also find the energy consumed by the bulb in 10 minutes.

Answers

Section-A

Answer 1.

(i) (b) Pendulums A, B, and D will also start vibrating but A and D will vibrate with the maximum amplitude.

Explanation :

When pendulum C is disturbed, the other three pendulums begin to vibrate as well, but because pendulum A and D are vibrate with same natural frequency and due to resonance, pendulum A and D vibrate with the maximum amplitude.

(ii) (d) The current through each resistor always remains the same.

Explanation :

When resistors are connected in series, the current flowing through the circuit is the same; however, when they are connected in parallel, the current through each resistor differs, but the voltage across all resistors is the same. If a resistor is removed from a parallel connection, current will continue flow across the circuits, whereas this is not the case with a series connection.

(iii) (d) Earth wire is used to prevent electric shock.

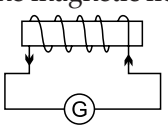
Explanation :

The potential of the neutral and earth wires are always kept at zero. The live wire has definite potential. In an electrical circuit, a fuse is always connected to the live wire to ensure that the appliance is not live when it is switched off. The earth wire connects the electric appliances to the earth, allowing any excess current or leakage of electric current to be flown to the ground. Thus, it prevents any possible electric shock to occur.

(iv) (a) Up

Explanation :

Applying Fleming's left hand rule, it can be said that the force on the current carrying conductor AB in the magnetic field will be in upward direction.

(v) (c) 

Explanation :

Applying the Lenz's law in the given situation, the right end of the solenoid will develop the polarity which will resist the movement of the bar magnet. Thus, when the bar magnet is moving rightward, the right end of the solenoid will develop South Pole and a clockwise current will flow through the circuit.

(vi) (c) 1 kg water absorbs 4200 J heat to increase its temperature by 1 kelvin.

Explanation :

The amount of heat required to increase the temperature of a particular substance's unit mass by one unit is referred as Specific heat capacity. Thus, Specific heat capacity of water is 4200 $Jkg^{-1} K^{-1}$ meaning, 1 kg of water requires 4200 J heat to increase its temperature by 1 K.

(vii) (a) 6720 J

Explanation :

Energy required to melt 200 g of ice , Q = m × L = 0.2 × 336000 = 67200 J.

(viii) (a) γ

Explanation :

Gamma rays (γ) are the most penetrating of the three types of radiation.

(ix) (c) A forced vibration, in which frequency of forced vibration is equal to the free vibrations of the body.

Explanation :

When the frequency of an externally applied periodic force equals the natural frequency of a body, the body begins to vibrate with more amplitude. Resonance is the term for this phenomena. Resonance is a special type of forced vibration. In other words, it is one type of forced vibration, in which frequency of forced vibration is equal to the free vibrations of the body.

(x) (d) Alpha

Explanation :

Because alpha particles are positive, they will be attracted to a plate that is negatively charged; and Beta particles are negatively charged, they are attracted to a positively charged plate.

Section-B

Answer 2.

(i) (a) Resistors 3 Ω and 5 Ω are in series. The equivalent resistance of these two is 8 Ω.

Now, this 8 Ω is connected with another 8 Ω resistors in parallel. The equivalent resistance of these two is = (8×8)/(8+8) = 4 Ω.

Thus, the total resistance across AB is 4 Ω.

(b) If a cell of e.m.f 2.4 V with negligible internal resistance is connected across AB then the current drawn from the cell is = Voltage (V)/ equivalent resistance (R) = 2.4/4 = 0.6 A.

(ii) (a) Latent heat of melting of 1 g ice at 0°C is 334 J. 10 g of ice at 0°C require 334 × 10 = 3340 J energy to melt down to 10 g of water at 0°C. Thus, this much additional energy 10 g ice can absorb as compared to 10 g water at 0°C.

(b) For the same mass of ice and ice-cold water, due to the absorption of latent heat by the ice, the ice produce more cooling than ice-cold water.

(iii) (a) As anticlockwise flow of current will occur at A, north pole will be produced at A; and as clockwise flow of current will occur at B, south pole will be produced at B.

(b) In order to increase the strength of the magnetic field in this coil, one can increase the number of turns on the coil and/or increase the current flow and/or placing an iron core inside the hollow card board cylindrical tube.

(c) If we place a soft iron bar at the centre of the hollow cardboard and replace the DC source by an AC source then there will be no attraction of small iron pins toward itself when the current is flowing through the coil. This is because AC will not create any magnetic effect, though it is a flow of free charged particles.

Answer 3.

(i) (a) mass of water (m) = 200 g = 0.2 kg.

Rate of heat extraction = 100 J/s.

So, total heat extracted for curve AB is = 100 × 640 = 64000 J

Now, for curve AB we can write,

$64000 = 0.2 \times C_p \times (353 - 273)$ [80°C = 273 + 80 = 353 K; 0°C = 273 + 0 = 273 K.]

Solving we get,

$C_p = 4000\ Jkg^{-1}K^{-1}$.

Thus, specific heat capacity of water is $4000\ Jkg^{-1}K^{-1}$.

(b) From the figure it is clear that at point B and C is corresponds to time 640 s and 1312 s, respectively.

Thus, heat released in region BC is = 100 × (1312-640) = 67,200 J.

(ii) (a) In the given figure it is observed that the bulb is connected with Live wire and the key is connected with Neutral wire. When the key or switch is ON, the path of current flow is completed, hence the bulb will glow.

(b) It is NOT safe to handle the bulb when the switch is OFF as bulb is directly connected to live wire.

(c) In the OFF position, the bulb remains connected to the high potential terminal through the live wire, but no current flows through the bulb, as the return path is incomplete. In this condition, it is not safe to touch the bulb even from outside. As a result, if the switch is connected to the neutral wire, it might be deceiving and even harmful to the user.

(iii) (a) It is given that, two metals A and B have specific heat capacities in the ratio 2 : 3. They are supplied same amount of heat.

Assuming, specific heat capacities of two metals A and B are 2 C and 3 C, respectively.

It is also given that, masses are same.

Let us take the heat amount is Q and masses are m.

So, for metal A,

Amount of heat (Q) = $m \times 2\ C \times \Delta t_A$;

and for metal B,

Amount of heat (Q) = $m \times 3\ C \times \Delta t_B$.

Now we can write, $m \times 2\ C \times \Delta t_A = m \times 3C \times \Delta t_B$.

Simplifying, $\Delta t_A = 1.5\Delta t_B$

Therefore, it can be said that metal A will show greater rise in temperature than metal B.

(b) In this case, rise in temperature is same (Δt) and masses are different.

So, for metal A,

Amount of heat (Q) = $m_A \times 2\ C \times \Delta t$;

and for metal B,

Amount of heat (Q) = $m_B \times 3\ C \times \Delta t$.

Now we can write, $m_A \times 2C \times \Delta t = m_B \times 3C \times \Delta t$.

Simplifying, $m_A = 1.5m_B$.

Therefore, it can be said that metal A will have greater mass than metal B.

(c) In this case mass ratio, $m_A/m_B = 3/5$.

we can write, $m_A \times 2\ C \times \Delta t_A = m_B \times 3\ C \times \Delta t_B$.

Or, $\Delta t_A/\Delta t_B = 3m_B/2m_A$

$= (3/2) \times (m_B/m_A)$

$= (3/2) \times (5/3) = 5/2$.

Or, $\Delta t_A : \Delta t_B = 5 : 2$.

Therefore, it can be said that for metal A and metal B, the ratio in which their temperatures rise is 5 : 2.

(d) It is given that, ratio of specific heat capacities, $C_A/C_B = 2/3$ and $C_A = 0.26$.

Calculating we get, $C_B = 1.5 \times 0.26 = 0.39$.

Therefore, specific heat capacity of metal B is $0.39\ Jg^{-1}°C^{-1}$.

Answer 4.

(i) (a) Graph A represents free vibration in vacuum and Graph B represents free vibration in medium.

(b) For free vibrations in vacuum, there is no resisting force, thus the amplitude will remain the same with time. Whereas for free vibrations in a medium there is always a resistive force, thus the amplitude reduces with time due to this resistive force.

(ii) (a) Faraday formulated the following two laws of electromagnetic induction:

First law: Whenever there is a change in magnetic flux linked with a coil, an e.m.f is induced. The e.m.f. induced lasts so long there is a change in magnetic flux linked with the coil.

Second law: The magnitude of e.m.f induced is directly proportional to the rate of change of magnetic flux linked with the coil. If magnetic flux changes at a constant rate, a steady e.m.f. is produced.

(b) Transformers works on the basis of Faraday's law of electromagnetic induction.

(iii) (a) ${}^{194}_{82}X$ emits an alpha particle.

We know, an Alpha particle consists of two protons and two neutrons $\left({}^{4}_{2}\alpha\right)$. On emitting an alpha particle the atomic number will reduce by 2 and the mass number will reduce by 4.

Thus, atomic number of the daughter nucleus Y is = 82 – 2 = 80.

Mass number of the daughter nucleus Y is = 194 – 4 = 190.

(b) Number of protons in daughter nucleus Y is = 80.

Thus, number of neutrons in daughter nucleus Y is = 190 – 80 = 110.

(c) Nuclear reaction showing the emission of this particle is, ${}^{194}_{82}X \xrightarrow{-\left({}^{4}_{2}\alpha\right)} {}^{190}_{80}Y$.

Answer 5.

(i) (a) The electrical appliance shown in the diagram is called 'Fuse'.

(b) The material used in 'Fuse' wire is made up of alloy of lead (Pb) and tin (Sn) having low melting point of 250°C.

(c) Characteristics of Fuse wire:

1. It has high resistivity.
2. It has low melting point.
3. It prevents electrical appliances from being damaged by a surge of high voltage current.
4. It is made up of alloy of lead (Pb) and tin (Sn).

(ii) (a) Pitch is the characteristic of sound that distinguishes an acute (or shrill) note from a grave or flat note.

(b) When both the wires are stretched by same amount, wire AB will produce sound of greater pitch on plucking.

(c) Pitch depends upon the frequency of the wave. More the frequency of the wave, higher is its pitch. In the given case, both the wires are of same length but wire AB is thinner than wire CD. So, wire AB will vibrate faster and have higher frequency than wire CD. Thus, pitch of wire AB is more compared to wire CD.

(iii) (a) When water passes through a pipe surrounded by a hot part of the engine, heat energy is removed from those parts. Because water has high specific heat capacity, water in pipes may extract more heat from the environment without significantly raising its temperature. As a result, the car's radiator and generator are both filled with water.

(b) Carbon-14 is a radioactive isotope which is used to find the age of fossils. It is Beta (β) radiation. When Carbon-14 emits a beta particle, it becomes Nitrogen-14.

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